

2: Electricity 1 – Topic questions

Paper 6

The questions in this document have been compiled from a number of past papers, as indicated in the table below.

Use these questions to formatively assess your learners' understanding of this topic.

Question	Year	Series	Paper number
3	2016	June	61
4	2016	June	63
1	2016	March	62

The mark scheme for each question is provided at the end of the document.

You can find the complete question papers and the complete mark schemes (with additional notes where available) on the School Support Hub at www.cambridgeinternational.org/support

- 3** A student is investigating the resistance of a lamp filament.
The circuit is shown in Fig. 3.1.

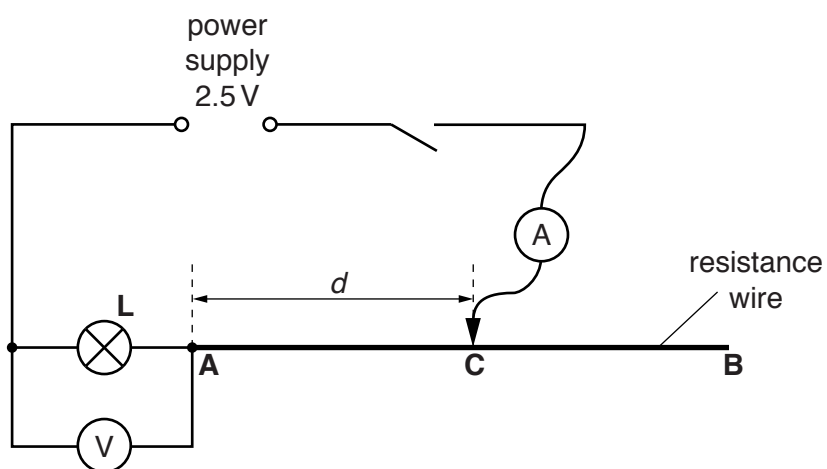


Fig. 3.1

- (a)** The student places a sliding contact **C** on the resistance wire at a distance $d = 0.200\text{ m}$ from point **A**. He measures the current I in the circuit and the p.d. V across the lamp **L**.

He repeats the procedure using values for d of 0.400 m , 0.600 m and 0.800 m . The readings are shown in Table 3.1.

- (i)** Calculate the resistance R of the lamp filament for each set of readings. Use the equation

$$R = \frac{V}{I}. \quad [2]$$

- (ii)** Complete the column headings in the table. [1]

Table 3.1

$d/$	$V/$	$I/$	$R/$	appearance of lamp filament
0.200	1.6	1.00		very bright
0.400	1.3	0.86		bright
0.600	1.0	0.74		dim
0.800	0.8	0.66		does not glow

- (b) The student notices that the lamp does not glow when he takes the final set of readings. He thinks that the filament has broken.

State whether the student is correct and give a reason for your answer.

statement

reason

..... [1]

- (c) A student suggests that the resistance R of the lamp filament should be constant.

Suggest, referring to the observations, a reason why the resistance R may not be constant in this experiment.

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.....

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..... [2]

- (d) (i) Name an electrical component that could be used, instead of the resistance wire **AB** and sliding contact, to vary the current I .

..... [1]

- (ii) Draw a diagram of the circuit including this component instead of the resistance wire and sliding contact.

[2]

[Total: 9]

- 4 The class is investigating a circuit containing two lamps in series. They are using the circuit shown in Fig. 4.1.

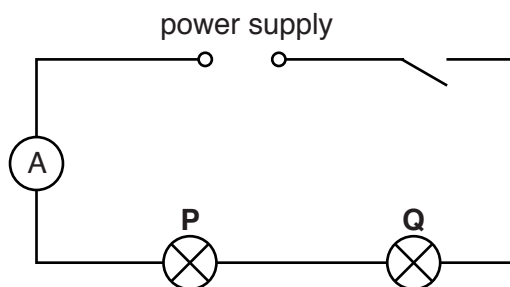


Fig. 4.1

- (a) On Fig. 4.1, use the standard symbol to show a voltmeter connected to measure the potential difference (p.d.) across lamp **P**. [1]
- (b) Record the current I in the circuit, as shown on the ammeter in Fig. 4.2.

$I = \dots\dots\dots$ [2]

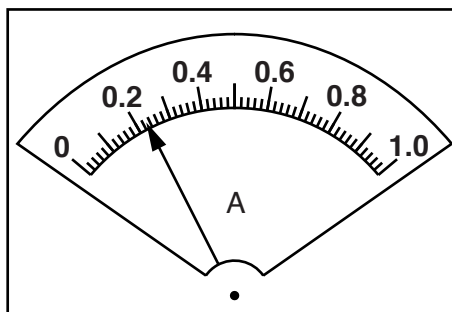


Fig. 4.2

- (c) Fig. 4.3 shows the readings on voltmeters connected to measure the potential difference across each lamp.

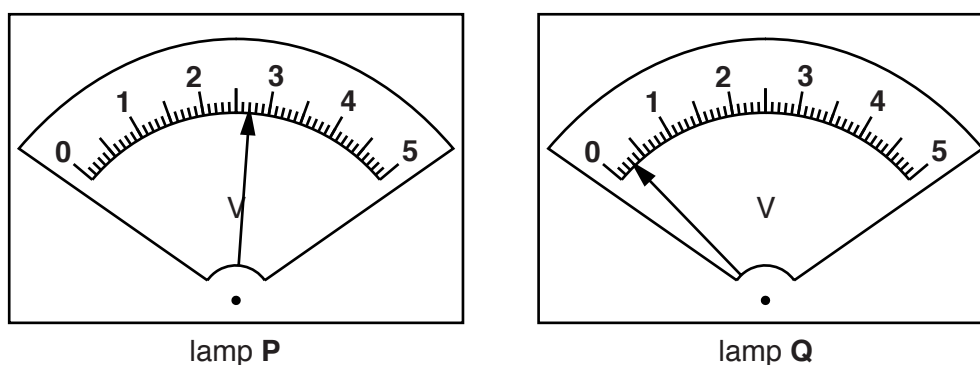


Fig. 4.3

In Table 4.1, record the potential difference V_P across lamp **P** and the potential difference V_Q across lamp **Q**.

Table 4.1

lamp	potential difference / V	observation of brightness
P	$V_P = \dots\dots\dots$	very bright
Q	$V_Q = \dots\dots\dots$	not glowing

[1]

- (d) Table 4.1 also shows the brightness of each lamp.

- (i) A student thinks that, as lamp **Q** is not glowing, its filament must have broken.

State one piece of evidence from the results in (b) and (c) that shows this cannot be the case.

.....
[1]

- (ii) The working potential difference for each lamp to be at its full brightness is 2.5V.

Suggest how the results for V_P and V_Q might help to explain the observations of the brightness of the lamps.

.....

[2]

- (e) Calculate the total resistance R of the lamps in the circuit, using the equation

$$R = \frac{(V_P + V_Q)}{I} .$$

$$R = \dots\dots\dots[2]$$

- (f) A student measures the potential difference V_S across the power supply.

$$V_S = \dots\dots\dots 3.1\text{V} \dots\dots\dots$$

He suggests that V_S should be equal to $V_P + V_Q$.

State whether the measurements support this suggestion. Justify your statement by reference to the results.

statement

justification

.....
[2]

[Total: 11]

- 1 Some students are investigating the relationship between potential difference and current for a resistor. They are using the circuit shown in Fig. 1.1.

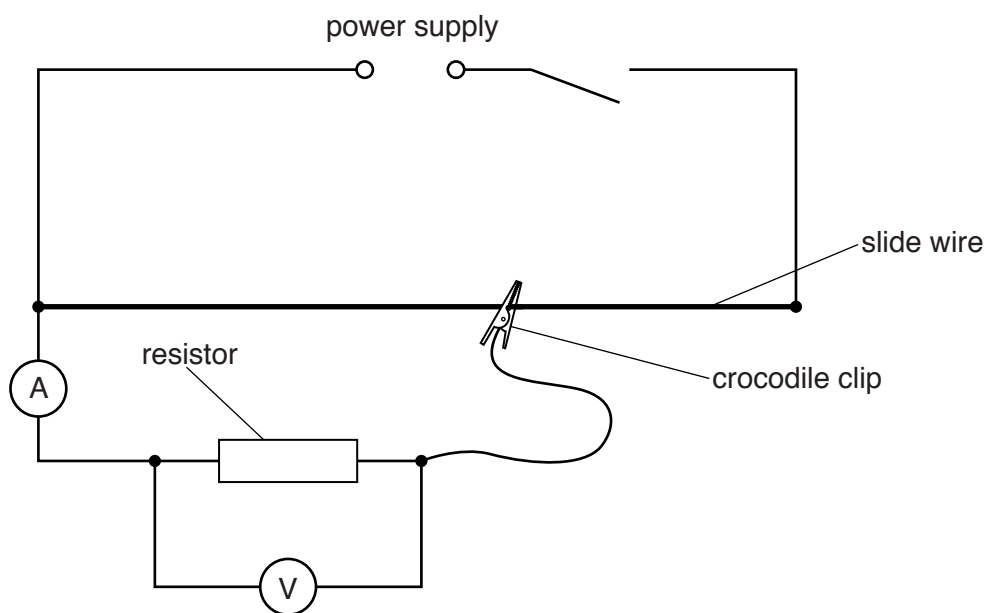


Fig. 1.1

The crocodile clip is connected at various positions on the slide wire, and the current and potential difference for the resistor are measured.

- (a) The readings of potential difference V and current I for various positions of the crocodile clip are shown in Table 1.1.

Draw arrows on Figs. 1.2 and 1.3 to show the meter readings for the values of V and I in the first row of the table.

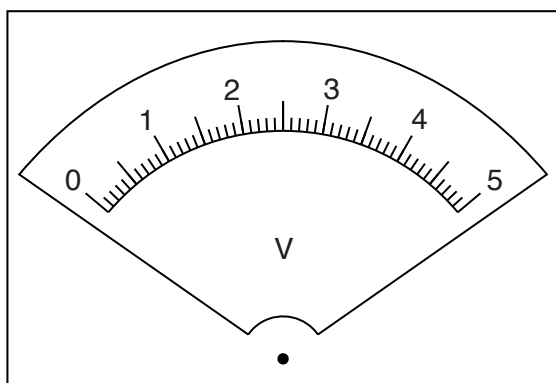


Fig. 1.2

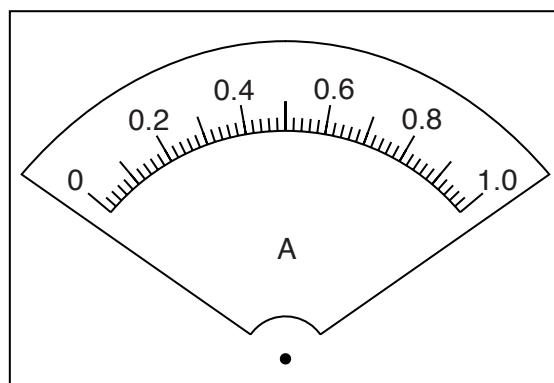


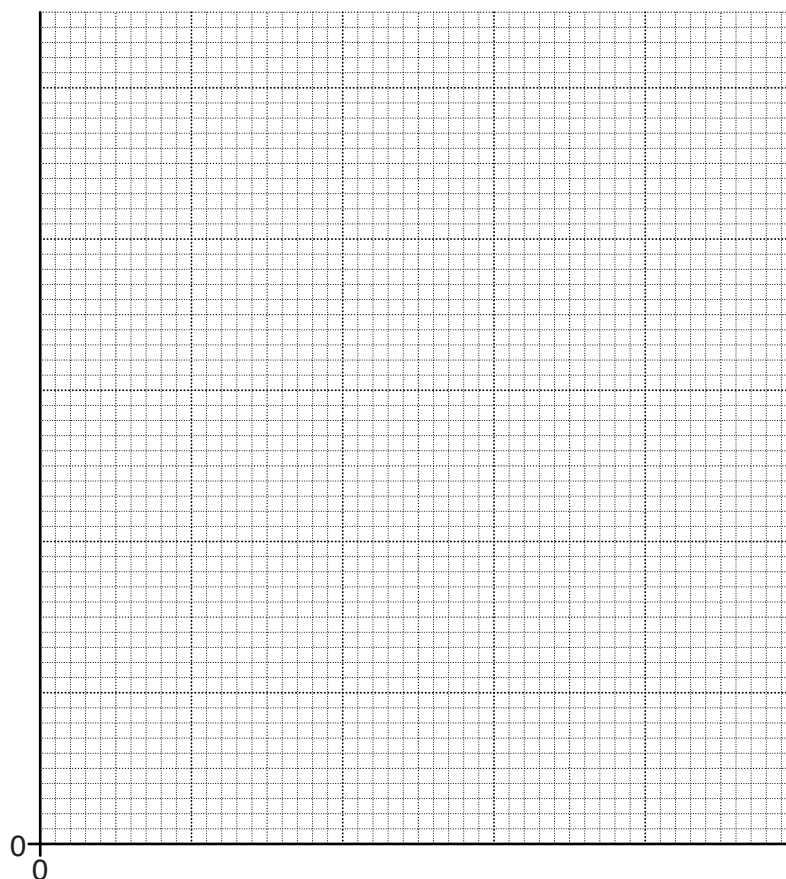
Fig. 1.3

[2]

Table 1.1

V/V	I/A
0.4	0.08
0.8	0.17
1.2	0.25
1.6	0.34
2.0	0.41

- (b)** Plot a graph of V/V (y-axis) against I/A (x-axis). Start both axes at the origin (0,0).



[4]

- (c) (i)** Determine the gradient G of the graph. Show clearly on the graph how you obtained the necessary information.

$G = \dots\dots\dots$ [1]

- (ii) The resistance value R of the resistor is numerically equal to G .

Give a value for R , to a suitable number of significant figures for this experiment. Include the unit.

$R =$ [2]

- (d) A student suggests that potential difference and current for this resistor should be proportional.

State whether your graph supports this suggestion. Justify your statement by reference to your graph.

statement

.....

justification

.....

.....

[2]

- (e) The students notice that the slide wire becomes very hot during the experiment.

Suggest a change to the apparatus or procedure that might prevent this.

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.....[1]

[Total: 12]

Question	Answer	Mark
3 (a) (i)	R values 1.60, 1.51, 1.35, 1.21 R values all to 2 significant figures or all to 3 significant figures.	1 1
3 (a) (ii)	Column headings m , V , A , Ω	1
3 (b)	No; there is a <u>current</u> reading	1
3 (c)	filament changes brightness, owtte increase/decrease/change in temperature of <u>filament/lamp</u>	1 1
3 (d) (i)	variable resistor (rheostat)	1
3 (d) (ii)	correct symbol for variable resistor correct diagram, with variable resistor in series with power supply	1 1
		Total: 7
4 (a)	correct voltmeter symbol in parallel with lamp P	1
4 (b)	$I = 0.23$ Unit of A	1 1
4 (c)	$V_P = 2.7$ <u>and</u> $V_Q = 0.3$	1
4 (d) (i)	some current in the circuit, pd across lamp Q is small / not equal to supply voltage / reference to lamp P bright <u>and is in series</u>	1
4 (d) (ii)	V_P greater than/near working voltage V_Q <u>much</u> less than working voltage	1 1
4 (e)	$R = 13(.0)$ allow e.c.f 2/3 sig figs and unit of Ω	1 1
4 (f)	statement matches results some correct values used and reference to 'within limits of experimental accuracy' owtte	1 1
		Total: 11

Question	Answer	Mark
1 (a)	arrow indicating 0.4 V arrow indicating 0.08 A	1 1
1 (b)	graph: <ul style="list-style-type: none"> axes labelled with quantity AND unit appropriate scales (plots occupy at least half of grid) plots all correct well-judged line AND thin line neat plots 	1 1 1 1
1 (c) (i)	G present and triangle method seen using at least $\frac{1}{2}$ line	1
1 (c) (ii)	R in range 4.6 Ω to 4.9 Ω to 2/3 sig figs and with correct unit	1 1
1 (d)	statement matching graph with reference to straight line reference to passing through origin (within limits of experimental accuracy / owtte)	1 1
1 (e)	suitable change, e.g. <ul style="list-style-type: none"> reduce supply voltage/current use thinner/longer wire material with greater resistivity 	1
		Total: 12

Notes about the mark scheme are available separately.